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CYPRESS SEMICONDUCTOR

CYPRESS SEMICONDUCTOR INVENTION DISCLOSURE FORM

DISCLOSURE NO. IC99001

1. INVENTOR(S)

A. Name I-Teh Sha Initials [REDACTED] Empl. No. [REDACTED] Ext. No. [REDACTED]

Citizenship Taiwan Dept # [REDACTED] Home Phone No. [REDACTED]

Home Mailing Address 1901 Halford Ave. Apt #100 Santa Clara, CA 95051

B. Name Kuang-Yu Chen Initials [REDACTED] Empl. No. 9125 Ext. No. 1115

Citizenship USA Dept # [REDACTED] Home Phone No. [REDACTED]

Home Mailing Address 20489 Chalet Lane, Saratoga, CA 95070

C. Name Albert Chen Initials [REDACTED] Empl. No. [REDACTED] Ext. No. [REDACTED]

Citizenship Taiwan Dept # [REDACTED] Home Phone No. [REDACTED]

Home Mailing Address 13901 River Ranch Circle, Saratoga, CA 95070

D. Name _____ Initials _____ Empl. No. _____ Ext. No. _____

Citizenship _____ Dept # _____ Home Phone No. _____

Home Mailing Address _____

2. TITLE OF INVENTION: DECREASING PLL OVERSHOOT OR DURING A FOR SPREAD SPECTRUM TRANSITION

3. CONCEPTION OF INVENTION

A. Date of first drawing or drawings

Where can first drawing be found? Engineering notebooks

B. Date of first written description

Where can description be found? Engineering notebooks

C. Date of first oral disclosure to others

To whom? Kuang-Yu Chen

Inventor(s) I-Teh Sha Date 7/30/99

Inventor(s) Kuang-Yu Chen Date 7/30/99

Inventor(s) Albert Chen Date 7/30/99

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4. CONSTRUCTION OF DEVICE

- A. Date completed _____
B. Was prototype made? _____
C. By whom made? _____
D. Where can the prototype be found? _____

5. TEST OF DEVICE

- A. Date: _____ Witness(es): Kuang-Yu Chen
B. Results: Successful

6. SALE

- A. Was invention sold or offered for sale? Yes No
B. Was invention used to make, assemble or test a commercial product? Yes No _____
C. Will invention be sold, offered for sale, sampled, or used to make, assemble or test a commercial product? Yes No _____
D. Actual or estimated date of first sale, offer or commercial use _____
E. Is invention part of a product for which there is a data sheet? Yes No _____ (if yes, attach a copy of the data sheet)
F. Actual or estimated date of publication, release or availability of data sheet November 1998

7. USE

- A. Is invention presently being used? Yes No _____
B. Are there specific plans for its use in near future? In what products or processes?
The whole invention has been implemented in the [redacted] family.

8. RELATED PUBLICATIONS, PATENTS, AND PATENT APPLICATIONS

9. WAS INVENTION: Conceived (Yes) (No) Constructed (Yes) (No) Tested (Yes) (No) during performance of Government Contract?

Inventor(s) W - Lin Shu Date 7/30/98

Inventor(s) Kuang Yu Chen Date 7/30/98

Inventor(s) Albert Chen Date 7/30/98

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Contract Number _____
(Give Full Contract Number)

The description of invention should be written in the inventor's own words and generally should follow the outline given below. Sketches, prints, photos, and other illustrations, as well as memos or reports of any nature in which the invention is referred to, if available, should form a part of this disclosure and reference and be made thereto in the descriptions of the invention's construction and operation.

FOR ANSWERS TO THE FOLLOWING QUESTIONS, USE THE REMAINDER OF SHEET AND THE ATTACHED SHEET(S).

1. General purpose of invention. State in general terms the objects of the invention.

To decrease the overshoot or undershoot in a PLL's frequency during the turn on or turn off of spread spectrum. This invention solves unpredictable transition period which could cause a CPU to hang when the spread spectrum transitions on or off.

2. Describe old technology, if any, for performing the function of the invention. Provide references, if available.

This problem has never been solved.

3. Indicate the disadvantages of the old technology.

No solution has been considered to spread spectrum transition behavior. Most of time, the transition happens unpredictably. Now it is controllable by programming and circuitry

4. Describe your invention and its construction, showing the changes, additions and improvements over the old method.

Inventor(s) W. Teh Lin Date 7/30/99

Inventor(s) Kun Yu Chen Date 7/30/99

Inventor(s) Albert Chen Date 7/30/99

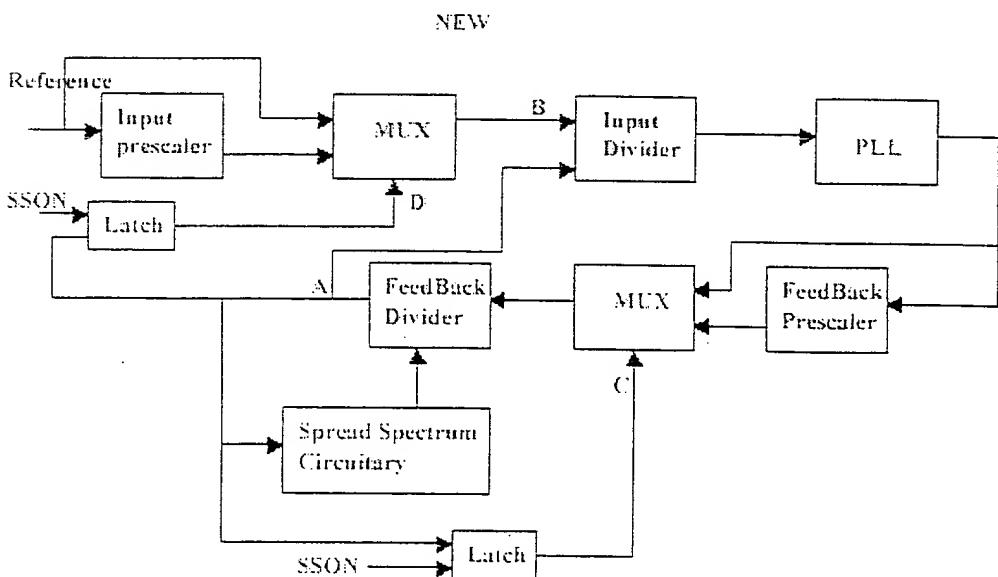
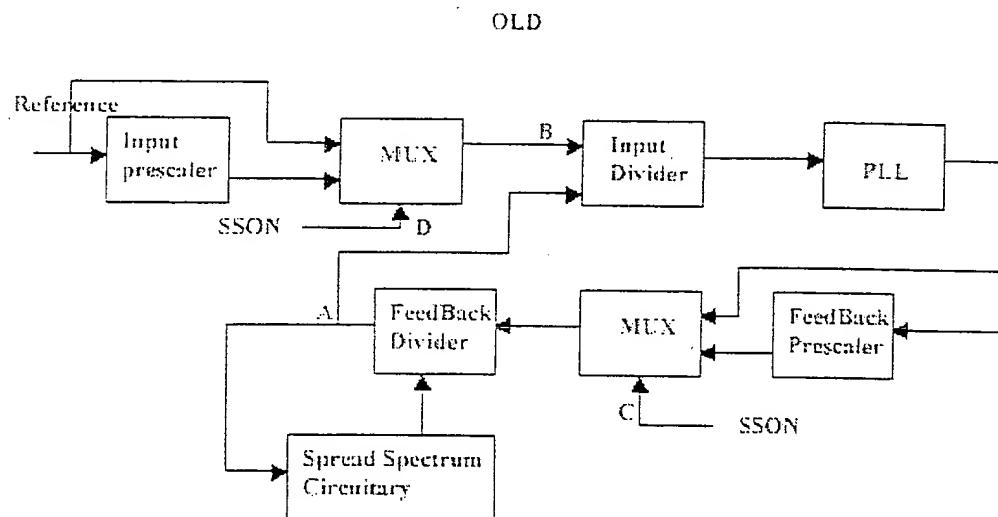
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1. Schematic



Inventor(s) J. Th. de Date 7/30/99

Inventor(s) Kun-Ji el Date 7/30/99

Inventor(s) Albert Chen Date 7/30/99

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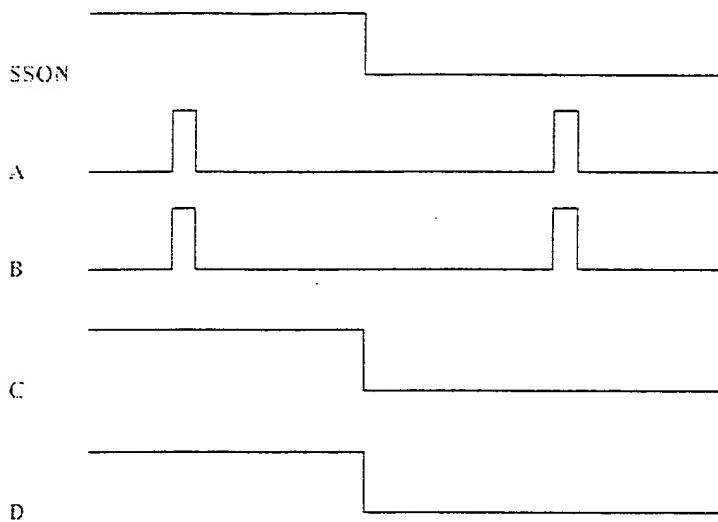
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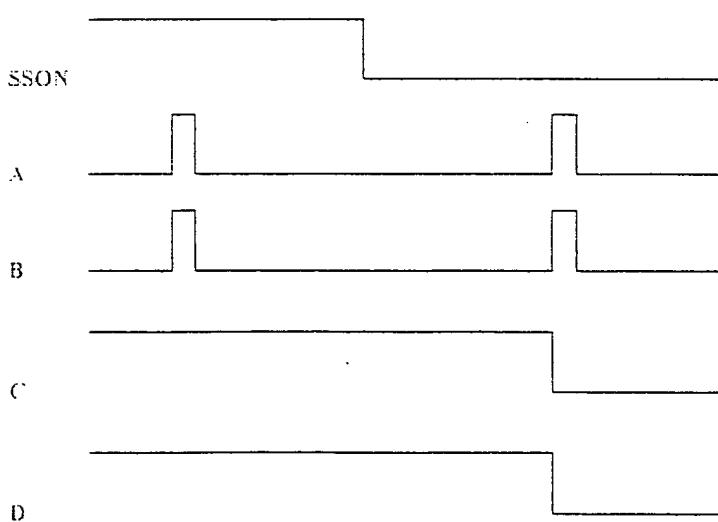
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2. Timing Diagram

OLD



NEW



Inventor(s) J. Shih Date 7/30/99

Inventor(s) Kun-ju Chen Date 7/30/99

Inventor(s) Albert Chen Date 7/30/99

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3. Formula

A. Using the following formula to generate Spread Spectrum ROM code

$$\begin{bmatrix} X_1(N+1) \\ X_2(N+1) \\ X_3(N+1) \\ X_4(N+1) \end{bmatrix} = \begin{bmatrix} 0 & -\frac{f_{CO}}{FBD(N+1)} & 0 \\ CP & \frac{1}{C_1 \cdot R_1} & \frac{1}{C_1 \cdot R_1} \begin{bmatrix} X_4(N) \\ X_3(N) \end{bmatrix} + \begin{bmatrix} U_1(N+1) \\ U_2(N+1) \end{bmatrix} & M(N) + \begin{bmatrix} X_1(N) \\ X_2(N) \end{bmatrix} \\ \frac{1}{C_1 \cdot R_1} & 0 & \frac{1}{C_1 \cdot R_1} \begin{bmatrix} X_4(N) \\ X_3(N) \end{bmatrix} + \begin{bmatrix} U_1(N+1) \\ U_2(N+1) \end{bmatrix} & M(N) + \begin{bmatrix} X_1(N) \\ X_2(N) \end{bmatrix} \\ 0 & \frac{1}{C_1 \cdot R_1} & 0 & \frac{1}{C_1 \cdot R_1} \begin{bmatrix} X_4(N) \\ X_3(N) \end{bmatrix} + \begin{bmatrix} U_1(N+1) \\ U_2(N+1) \end{bmatrix} & M(N) + \begin{bmatrix} X_1(N) \\ X_2(N) \end{bmatrix} \end{bmatrix}$$

R₁=40 k at SSCG off

R₂=24 k at SSCG on

U_i(N) is changed when SSCG switches OFF-ON or ON-OFF

B. Input FBD(N) to PLL's transient program that optimize the FBD(N) order in ROM address.

C. [REDACTED]

Inventor(s) W. John Shu Date 7/30/99
Inventor(s) Kun Yp Ch Date 7/30/99
Inventor(s) Albert Chen Date 7/30/99

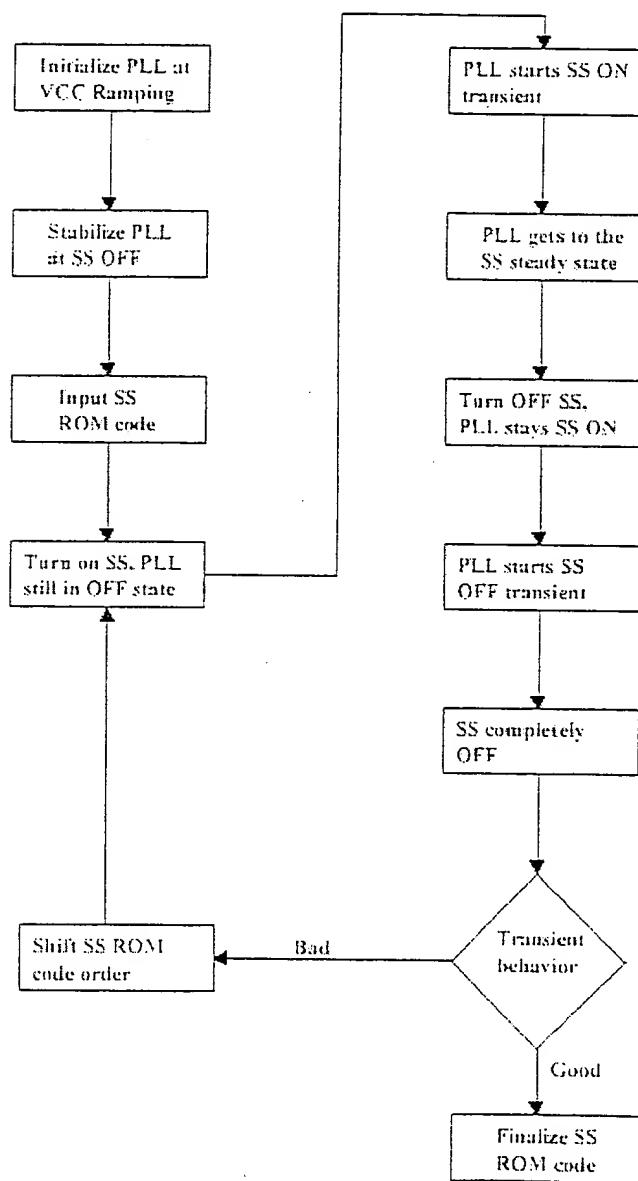
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4. [REDACTED]



Inventor(s) J. Th. de Date 7/30/99

Inventor(s) Kun-fu cl Date 7/30/99

Inventor(s) A/Hart Chan Date 7/30/99

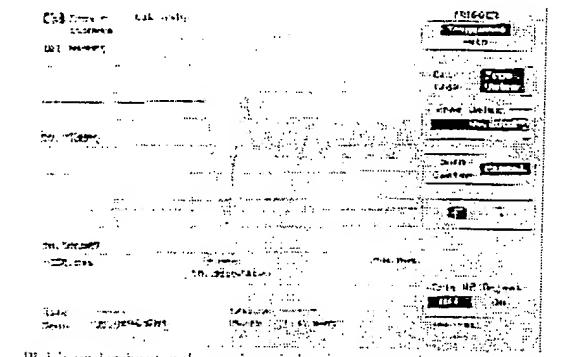
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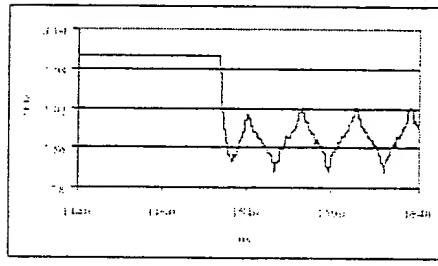
CYPRESS SEMICONDUCTOR INVENTION DISCLOSURE FORM

5. Simulated and measured results

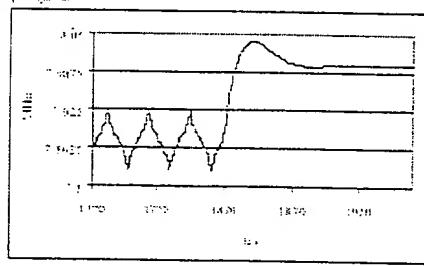


PLL's undershoot and overshoot behavior in spread spectrum transition

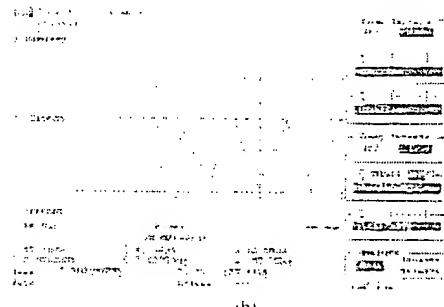
Spread Spectrum transition behaviors are controlled by the program



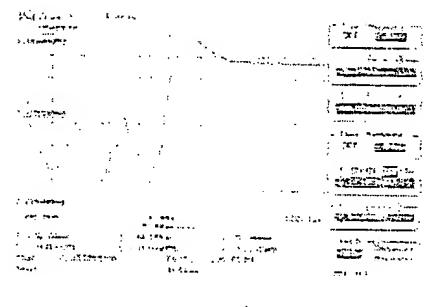
(a)



(b)



(a)



(b)

(a) Simulation (b) Measured results in off-on transition

(a) Simulation (b) Measured results in on-off transition

Inventor(s) W - Wei Shu Date 7/30/99

Inventor(s) John F. Chen Date 7/30/99

Inventor(s) Albert Chen Date 7/30/99

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5. Give details of its operation (i.e., how is your invention used?), if not already described under 4.
6. State the advantages of your invention over what has been done before.

The transient behavior of a spread spectrum can be fully controllable. It prevents PLL's overshoot or undershoot from switching ss on or ss off.

7. Indicate any alternate component(s) and/or method(s) of construction.
8. If a joint invention, indicate what contribution was made by each inventor.

I-Teh Sha

Implement PLL's steady state and transition model
The concept of ROM code shifting to improve SSIG's
transition behavior

Kuang-Yu Chen

Albert Chen

Synchronized circuitry and layout implement.

9. Describe the features that are believed to be new.

1. FORTRAN program is used to determine transient and steady-state spread spectrum behavior.
2. All dividers and prescalers are synchronized.
3. Transient behavior is simulated starting from steady-state condition

10. State opinion of relative value of invention.

This invention will apply to most of the existing spread spectrum devices. For spread spectrum applications, all EMI reduction chips need to add this invention in order to avoid CPU clock tracking failure during spread spectrum on-off or off-on transition.

11. After the disclosure is prepared, it should be signed by the inventor(s) and then read and signed by two witnesses in the space provided at the bottom of each sheet.

Inventor(s) I-Teh Sha Date 7/30/99

Inventor(s) Kuang-Yu Chen Date 7/30/99

Inventor(s) Albert Chen Date 7/30/99

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